511.5.01 Adjustments

A. Plan Quantities

Assume the burden of proof for errors of commission or omission in the Plan quantities.

The Department will not consider requests for additional monies because of Plan errors unless they are submitted with the bar lists and weights described in Subsection 511.1.03.B, "Bar Lists and Calculated Weights." Projects involving multiple bridges or non-skewed concrete box culverts will be considered on an individual basis.

Quantities for bridges and concrete box culverts shown on the Contract Plans (including Standard Plans) will be considered the Base Pay Quantity. Calculated additions or deductions will be applied to the Base Pay Quantity when quantity changes authorized by the Engineer are made. Changes include, but are not limited to, the following:

- Raising or lowering foundations
- Lengthening or shortening concrete box culverts
- Correcting Plan quantity errors or placement details

B. Lump Sum Payment

When authorized quantity changes in the bar reinforcement Plan Quantity are made, Lump Sum payments will be adjusted on a pro-rata basis as follows:

1. If the calculated bar reinforcement weights furnished by the Contractor differ from the Plan Quantity by more than two percent, the Bridge Office will recalculate the plan quantity.

If the recalculated Plan Quantity differs by more than two percent from the original Plan Quantity, the Plan quantity will be revised by the Bridge Office to equal the recalculated quantity or the Contractor's quantity, whichever is lower. The Lump Sum payment will be adjusted on a pro-rata basis.

When the Contractor exercises an optional feature of the Plans that results in the only increase or decrease to the Base Pay Quantity, there will be no increase or decrease in payment. However, if the two percent variation is being considered, the effects of the optional feature will favor the Department.

C. Prestressed Concrete Deck Panels

Payment for prestressed concrete deck panels will be 35 percent of the lump sum superstructure reinforcement steel price. Payment will be made after panels are placed.

Payment for post-tensioned box girder bridges will be 35 percent of the lump sum superstructure reinforcement steel price only for the reinforcement steel in the top slab of the box.

Section 512—Shear Connectors

512.1 General Description

This work consists of furnishing and welding shear connectors as shown on the Plans. This work is a Pay Item only when specified in the Contract.

512.1.01 Definitions

General Provisions 101 through 150.

512.1.02 Related References

A. Standard Specifications

Section 501—Steel Structures

B. Referenced Documents

ASTM A 709, Grade 36 (ASTM A 709M, Grade 250)

512.1.03 Submittals

General Provisions 101 through 150.

512.2 Materials

Materials shall meet the following requirements:

- Unless otherwise specified, channel type shear connectors shall be manufactured from structural steel meeting ASTM A 709, Grade 36 (ASTM A 709M, Grade 250).
- Use the stud type shear connectors of the size or diameter and length specified on the Plans. Do not paint or galvanize studs.

  Ensure that stud type shear connectors and the welding comply with Subsections 501.3.04.H, and 501.3.06.C, "Welded Construction."

For a list of sources, see QPL 6.

512.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

512.3 Construction Requirements

512.3.01 Personnel

General Provisions 101 through 150.

512.3.02 Equipment

Ensure that equipment for welding, chipping, and oxygen cutting is designed, manufactured, and maintained so that qualified welders and welding operators can meet the Specification requirements.

512.3.03 Preparation

General Provisions 101 through 150.

512.3.04 Fabrication

General Provisions 101 through 150.

512.3.05 Construction

A. Fabricate Shear Connectors

Fabricate shear connectors according to the Specifications and the Plan details.

1. Channel Type Shear Connectors

   Length tolerances for cutting the channel type are plus 1/2 in (13 mm) and minus 1/4 in (6 mm).
2. Stud Type Shear Connectors

   The stud length specified shall be the length after welding.

B. Construct Shear Connectors

Shear connectors may be welded to the girder flanges' beam either in the shop or at the site.

In either case, ensure that shear connector welding and construction complies with Subsections 501.3.04.H, and 501.3.06.C, "Welded Construction," the Plan details, and the following:

1. Before welding, prepare shear connectors and base metal as follows:
   a. Clean the shear connectors and the base metal of rust, scale, oil, paint, and other harmful substances that would affect the welding operation and the bonding to concrete.

      If the connectors are excessively pitted or cannot be cleaned, they will be rejected.
   b. Wire-brush, peen, prick-punch, or grind the base metal where the shear connectors will be welded. Perform this step only when necessary to obtain satisfactory welds.
2. Do not weld shear connectors when the temperature of the base metal is below 0 °F (-18 °C) or when the surface is wet or exposed to rain or snow.
3. Install shear connectors as follows:
   a. Channel Type Shear Connectors

      Location tolerances for individual connectors are plus or minus 1/4 in (5 mm) from the Plan location. Place connectors at right angles to the beam flanges.

b. Stud Type Shear Connectors

Install stud type shear connectors according to Subsections 501.3.04.I.2, “Paragraph 3.10.1” and 501.3.04.I.3, “Paragraph 4.30.1.”

C. Repair Defective Welds

Repair defective welds, shear connectors, and base metals as follows:

1. Channel Type Shear Connectors

   Repair channel type shear connectors as follows:

   a. Repair undersized but otherwise sound welds by bringing the weld up to size with additional welding.
   b. Repair undercut caused by the welding process by filling with additional weld metal.
   c. Repair unsound welds as follows:
      1) Remove the weld by chipping.
      2) If removing unsound welds damages the base metal, repair the base metal by welding and grinding before rewelding the shear connector.
      3) Replace the weld with sound welds.

2. Stud Type Shear Connectors

   Repair stud type shear connectors according to Subsections 501.3.04.I.2, “Paragraph 3.10.1” and 501.3.04.I.3, “Paragraph 4.30.1.”

512.3.06 Quality Acceptance

A. Inspect Welds

The Engineer will inspect and must approve shear connector welds before the Contractor encases them in concrete. The Engineer will inspect them as follows:

1. Channel Type Shear Connectors

   The Engineer will visually inspect the welds to determine the following:

   - Welds are sound.
   - Welds are the size shown on the Plans.
   - Welds are the proper profile.

   If the Engineer finds defective welds, they shall be repaired at the Contractor’s expense as specified in Subsection 512.3.05.C, “Repair Defective Welds.”

2. Stud Type Shear Connectors

   The Engineer will inspect stud type shear connectors according to Subsections 501.3.04.I.2, “Paragraph 3.10.1” and 501.3.04.I.3, “Paragraph 4.30.1.”

512.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

512.4 Measurement

When a Pay Item for shear connectors is specified in the Contract, the quantity measured for payment will be the pounds (kilograms) of installed shear connectors accepted.

Pay quantities will be computed as follows:

1. **Channel Type Shear Connectors.** The weight will be computed for the length and nominal weight per foot (meter) shown on the Plans.
2. **Stud Type Shear Connectors.** The weight will be computed from the nominal dimensions of a stud as shown on the Plans.

512.4.01 Limits

A. Weights

The weights of weld metal flux, arc shield, etc., will not be included in the pay quantity, but their costs shall be included in the Contract Price for this Item.

B. Separate Measurement

Generally, there will be no Pay Item specified for shear connectors in the Contract. Therefore, there will be no separate measurement, and the cost of furnishing and installing the connectors shall be included in the Contract Price for structural steel.

512.5 Payment

When a Pay Item is specified for shear connectors in the Contract, the work will be paid for at the Contract Price per pound (kilogram) for shear connectors of the specified type, complete in place.

Payment will be made under:

Item No. 512	Channel Shear Connectors	Per pound (kilogram)
Item No. 512	Stud Shear Connectors	Per pound (kilogram)

512.5.01 Adjustments

General Provisions 101 through 150.

Section 513—Precast Reinforced Concrete Box Culverts

Barrel Sections and End Sections

513.1 General Description

This work consists of constructing, transporting, joining, and finishing precast box culvert installations (normally as alternates to cast-in-place box culverts) according to Plan details and these Specifications.

Use precast boxes only in these situations:

- Under allowable fill heights designated on the Plan details
- As approved

Design numbers for precast barrel sections refer to Plan designations.

Precast ends refer to precast wingwalls, parapets, apron sections, toewalls, and baffles for outlets.

513.1.01 Definitions

General Provisions 101 through 150.

513.1.02 Related References

A. Standard Specifications

Section 207—Excavation and Backfill for Minor Structures

Section 500—Concrete Structures

Section 506—Expanded Mortar

Section 834—Masonry Materials

Section 843—Concrete Pipe

Section 848—Pipe Appurtenances

Section 852—Miscellaneous Steel Materials

B. Referenced Documents

ASTM C 789

AASHTO M 259

AASHTO M 36

AASHTO M 252